MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

BST1034 – STATISTICS FOR MANAGERS

(All sections / Groups)

3 MARCH 2016
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 8 pages with **4** questions only.
2. Attempt **ALL** the questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Students are allowed to use scientific calculators (without restriction).
4. Statistical formulae are attached at the end of the question paper.
5. Please write all your answers in the Answer Booklet provided.

QUESTION 1

(a) Consider the following set of a sample data:

26.9	26.7	27.0	31.4	29.0	26.6	32.8
32.1	28.5	35.2	27.3	29.9	27.4	36.3

(i) Compute the mean and standard deviation for these sample data. (4 marks)

(ii) Calculate the coefficient of variation for these sample data. (2 marks)

(b) Personal Locator Beason (PLB) is a special device which aid in the detection and location of boats, aircraft, and people in distress. The AAA company makes 80% of the PLBs, the BBB Company makes 15% of them and the CCC Company makes the other 5%. The PLBs made by AAA have a 4% rate of defects, the BBB PLBs have a 6% rate of defects and the CCC PLBs have a 9% rate of defects.

(i) Find the probability of randomly selecting a PLB and getting one manufactured by the CCC Company. (2 marks)

(ii) If a randomly selected PLB is found to be defective, find the probability that it was made by the AAA Company. (5 marks)

(iii) Calculate the probability it is from BBB Company and unbroken. (2 marks)

(c) A manufacturer of metal gaskets finds that on the average, 12% of his gaskets are rejected because they are either oversize or undersize. What is the probability that a batch of 10 gaskets will contain

(i) no more than 2 rejects? (3 marks)

(ii) at least 2 reject? (2 marks)

(d) Vehicles pass through a junction on a busy road at an average rate of 300 per hour.

(i) What is the expected number passing in two minutes? (2 marks)

(ii) Find the probability that none passes in a given minute. (3 marks)

(Total: 25 Marks)

Continued...

QUESTION 2

(a) A branch of a bank located in a commercial district of a city has the business objective of improving the process for serving customers during the 12pm to 1pm lunch period. The waiting time (defined as the time the customer enters the line until he reaches the teller counter) of a random sample of 24 customers is collected. The results are shown as below:

4.21	5.67	2.34	6.08	4.76	2.89	4.45	3.89
3.34	4.36	3.55	2.67	4.41	4.22	2.04	3.49
4.56	3.47	3.91	5.32	5.51	3.23	4.11	3.66

(i) Construct a 90% confidence interval estimate for the mean waiting time of the customer during the lunch period. (7 marks)

(ii) Is there any significant evidence that the average waiting time is less than 4.5 minutes at the 0.01 significance level? (8 marks)

(b) A survey studied whether undergraduates nowadays will spend average of 3 days per week on doing exercise in order to perform a healthy lifestyle. The sample of this survey is selected from 200 male undergraduates and 180 female undergraduates in one of the university in state. The result showed that 35% of male undergraduates and 25% of female undergraduates spent average of 3 days per week on doing exercise. Can we conclude that male undergraduates perform healthier lifestyle by spending average of 3 days per week on doing exercise than female undergraduates at the 1% significance level? (10 marks)

(Total: 25 Marks)

QUESTION 3

(a) An investment advisor is interested to know whether there is a difference in the annualised average returns (in RM) between four different investment portfolios: Aggressive, Balance, Growth and Conservative. The summary and analysis of variance (ANOVA) of the portfolios are shown in the following:

SUMMARY

Portfolios	*No. of stocks*	*Average return*	*Variance*
Aggressive	16	431.50	150392.27
Balance	16	407.31	61055.96
Growth	15	421.93	63002.92
Conservative	12	408.25	54493.66

Continued...

ANOVA

Source of Variation	*SS*	*df*	*MS*
Between Groups	***	3	***
Within Groups	***	***	***
Total	4659308.1356	58	

(i) Compute the Sum of Squares Within (*SSW*) the portfolios and hence complete the ANOVA table. (6 marks)

(ii) By assuming that the populations have equal variances and are normally distributed, what conclusion can be made by the investment advisor at the 5% significance level? (7 marks)

(b) An economist would like to examine whether there is a relationship between Melaka's foreign direct investments (rounded to the nearest million) and its level of crime rates (High, Moderate, and Low). The related information of fifty randomly selected foreign investors is provided in the following table:

Level of crime rates	Foreign direct investments			
	1 - 10	11 - 20	21 - 30	> 30
High	3	2	4	1
Moderate	6	4	3	2
Low	7	8	6	4

Is there a relationship between Melaka's foreign direct investments and its level of crime rates at the 10% significance level? (12 marks)

(Total: 25 Marks)

QUESTION 4

(a) The manager of a fast food restaurant would like to develop a model to predict the time it takes to deliver food to their customer. Data were collected from the past 15 orders, the delivery time and distance from the restaurant are as following.

Distance (KM)	1	2.7	9.6	6.2	6.7	9.3	2	1.6	3.9	8.9	1.7	2.4	7.8	3.9	9.3
Delivery Time (Minutes)	3	8	27	14	16	26	6	5	10	22	5	7	19	11	25

(i) Compute the coefficient of correlation and interpret your answer. (4 marks)

(ii) Find the regression line of the delivery time. (5 marks)

Continued...

(iii) Estimate the time needed to deliver food to a customer who is 6 km away from the restaurant. Is this estimation reliable? (2 marks)

(b) The following ANOVA table is obtained from a multiple linear regression model with five independent variables.

ANOVA Table

Source of Variation	*df*	*Sum of Squares*	*Mean Squares*
Regression	**	**	**
Residual	**	120.22	**
Total	24	250.32	

(i) Complete the ANOVA table. (2 marks)

(ii) Test whether the regression model is statistically significant at 5% significance level. (5 marks)

(c) The following are the prices and quantities of four sport equipment sold in the market for the year 2014 and 2015:

Type of Sport Equipment	**Year (2014)**		**Year (2015)**	
	Price (RM)	**Quantity**	**Price (RM)**	**Quantity**
Ankle Guard	30	1000	32	1200
Knee Guard	65	1500	70	1760
Yoga Mat	38	325	40	380
Elbow Support	42	100	45	110

(i) Calculate a Paasche aggregate price index for year 2015, using 2014 as the base year. (3 marks)

(ii) Calculate a Laspeyres aggregate price index for year 2015, using 2014 as the base year. (3 marks)

(iii) Calculate the Fisher's Ideal Price Index for year 2015. (1 mark)

(Total: 25 Marks)

End of Page

STATISTICAL FORMULAE

A. Descriptive Statistics

Ungrouped Data

$$\text{Mean} = \frac{\sum x}{n}$$

$$\text{Standard Deviation (s)} = \sqrt{\frac{\sum x^2}{n-1} - \frac{(\sum x)^2}{n(n-1)}}$$

Grouped Data

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard Deviation (s)} = \sqrt{\frac{\sum fx^2}{\sum f - 1} - \frac{(\sum fx)^2}{\sum f(\sum f - 1)}}$$

$$\text{Median} = L_m + \left[\frac{\left(\frac{\sum f}{2} - F_{m-1}\right)}{f_m}\right]c$$

$$\text{Mode} = L_m + \left[\frac{(f_m - f_{m-1})}{2f_m - f_{m-1} - f_{m+1}}\right]c$$

B. PROBABILITY

Poisson Probability Distribution

If X follows a Poisson Distribution P (λ) where $P(X = x) = \frac{e^{-\lambda}\lambda^x}{x!}$

then the mean = E(X) = λ and variance = VAR(X) = λ

Binomial Probability Distribution

If X follows a Binomial Distribution B(n, p) where $P(X = x) = {}^nC_x p^x q^{n-x}$

then the mean = E(X) = n p and variance = VAR(X) = npq where q = 1 - p

Normal Distribution

If X follows a Normal distribution N(μ , σ) where E(X) = μ and VAR(X) = σ^2

then $Z = \frac{X - \mu}{\sigma}$

C. HYPOTHESIS TESTING

One Sample Mean Test

***Z*-test**	***t*-test**
$Z = \dfrac{\bar{x} - \mu}{\dfrac{\sigma}{\sqrt{n}}}$	$t = \dfrac{\bar{x} - \mu}{\dfrac{s}{\sqrt{n}}}$

One Sample Proportion Test

$$Z = \frac{p - \pi}{\sqrt{\dfrac{\pi(1-\pi)}{n}}}$$

Two Sample Mean Test

***Z*-test**

$$Z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}}$$

***t*-test**

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{S_p\sqrt{\left(\dfrac{1}{n_1} + \dfrac{1}{n_2}\right)}} \quad \text{where} \quad S_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

Two Sample Proportion Test

$$Z = \frac{(p_1 - p_2) - (\pi_1 - \pi_2)}{\sqrt{\bar{p}(1-\bar{p})\left[\dfrac{1}{n_1} + \dfrac{1}{n_2}\right]}} \quad \text{where} \quad \bar{p} = \frac{x_1 + x_2}{n_1 + n_2}$$

where x_1 and x_2 are the number of successes from each population

D. ANALYSIS OF VARIANCE

$$SST = \sum_{i=1}^{k}\sum_{j=1}^{n_j}(X_{ij} - \bar{\bar{X}})^2 \qquad SSB = \sum_{i=1}^{k} n_i(\bar{X}_i - \bar{\bar{X}})^2$$

$$SSW = \sum_{i=1}^{k}\sum_{j=1}^{n_j}(x_{ij} - \bar{x}_i)^2 \quad \text{or} \quad SSW = \sum_{i=1}^{k}(n_i - 1)s_i^2$$

E. CHI-SQUARE ANALYSIS

$$\chi^2 = \sum \frac{(o_i - e_i)^2}{e_i}$$

o_i = observed frequency in a particular cell
e_i = expected frequency in a particular cell

Expected cell frequencies for Independent Test:

$$e_i = \frac{row\ total \times column\ total}{n}$$

F. REGRESSION ANALYSIS

Simple Linear Regression

$$Y = a + bX, \quad \text{where } b = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}} \text{ and } a = \bar{y} - b\bar{x}$$

Correlation Coefficient

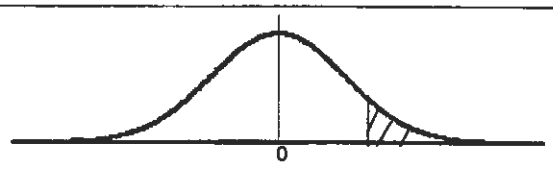
$$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

G. INDEX NUMBERS

Simple Price Index $P = \frac{p_t}{p_0} \times 100$	**Laspeyres Quantity Index** $P = \frac{\sum p_0 q_t}{\sum p_0 q_0} \times 100$
Simple Aggregate Price Index $P = \frac{\sum p_t}{\sum p_0} \times 100$	**Paasche Quantity Index** $P = \frac{\sum p_t q_t}{\sum p_t q_0} \times 100$
Laspeyres Price Index $P = \frac{\sum p_t q_0}{\sum p_0 q_0} \times 100$	**Fisher's Ideal Price Index** $\sqrt{(\text{Laspeyres Price Index})(\text{Paasche Price Index})}$
Paasche Price Index $P = \frac{\sum p_t q_t}{\sum p_0 q_t} \times 100$	**Value Index** $V = \frac{\sum p_t q_t}{\sum p_0 q_0} \times 100$

Table 1

The Upper Tail Area Under the Standard Normal Curve



Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
3.5	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
3.6	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000